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Funsigns - An Interactive Educational Tool to Learn Sign Language

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RIT

Funsigns - An Interactive Educational Tool

to Learn Sign Language

by

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the Degree of Master of Fine Arts in Visual Communication Design Program

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Abstract

This thesis aims to provide an educational and interactive tool where deaf children and their hearing parents can learn, bond, enjoy and interact with each other.

More than 90% of children which severe to profound hearing losses are born to normally hearing families. When parents are told that their child is deaf, their dreams are crushed and a grief response may be triggered (Weaver, K. A., & Starner, T, 2011). Due to this lack of knowledge when faced with a deaf family member for the first time, parents tend to base their perceptions on obsolete stereotypes which can greatly affect the development of the child. Delayed cognitive and language development in early childhood that leads to academic difficulties and underperformance when they begin schooling. Despite the government, schools, and professionals having good intentions, this situation persists, leading to significant under-education and underemployment for persons who are deaf or hard of hearing. Because there is not enough spoken or sign language, the effects of early language deprivation or limited exposure to language are often very serious, leading to serious problems in the health, education and quality of life issues of this children. Family engagement has a more positive impact if it begins early in a child's educational experience.

My solution is using object recognition with augment reality to help facilitate language acquisition for deaf kids and their hearing parents. Through this thesis project, I intend to

develop an interactive tool that engages a deaf child and their hearing family to learn sign language together, create better communication and improve life quality.

According to existing education sign language ways, most of them are still in a traditional way like books, online or offline course and some text/image oriented applications. An interactive visualized educational tool give family more motivation to learn the knowledge and help them learn it in an efficient and cheerful way. Integrating with augmented reality technology has also created a new method to display the content in this field.

Keywords: Deaf children, hearing parents, sign language, learn, interactive, augmented reality

Introduction

In the United States, from 90 to 95 percent of deaf children are born to hearing parents. Generally, the majority of these parents lack the skill of American Sign Language (ASL), which is the most accessible language to communicate with their deaf children. Therefore, deaf children with hearing parents are often not exposed to language-driven interactions at an early stage of development. In addition, hearing parents often express feelings of failure or sorrow related to a child's deafness, which they may view as a handicap.

Young deaf and hard of hearing children continue to experience delayed cognitive and language development in early childhood that lead to academic difficulties and underperformance when they begin schooling (Mayer, C, 2007). The effects of early language deprivation or limited exposure to language due to not having sufficient access to spoken language or sign language are often so severe as to result in serious health, education and quality of life issues for these children. In addition, compared to hearing peers, general deaf students have been presented a lower level of linguistic competence.

Families are their children's first teachers and have a powerful influence on the development of their young children, especially on deaf or hard-of-hearing children. Studies have shown that

parental involvement with deaf children is instrumental in the instructing of academic, language, social and handle their behaviors.

Various technologies have been well applied as educational tools for deaf children, although many of the technologies are limited in capability and form. However, the solutions which focus on the interaction between the deaf children and their hearing parents are almost non-existent. Appropriate solutions are needed to link deaf children to hearing parents, to promote mutual understanding, to provide effective means of expression for deaf children, and to develop their cognitive development and language skills.

Context

Problem Statement

How may we create an interactive tool to engage deaf children and their hearing parent learning ASL?

As data shows, 90 to 95 percent of deaf children are born to hearing parents who often don't know sign language. Hearing parents of deaf children face all of the challenges of parenthood plus the need to learn a completely new language for communicating with their child (Elizabeth Dougherty, 2017). However, American Sign Language is an important developmental tool that will help deaf child acquire a foundation for thinking and language (signed or spoken), learning just a few basic signs will help hearing parents start to communicate and connect with their deaf children (Moeller, M.P, 2000). Interactive platforms can play an useful role in educating them together when they face the challenges. With AR object recognition technology, users can learn ASL whether they are. Also, they can get real-time feedback from the platform based on body-tracing. A better language environment can be provided for the deaf children and their hearing parents.

Target Audience

As data shows, 90 to 95 percent of deaf children are born to hearing parents who often don't know sign language. Many deaf children—perhaps as many as 70 percent—are deprived of language (). Exposure to language from birth is essential for the development of thinking skills, according to a range of studies. Now research in the Deaf Studies program is shifting the focus to younger children, from birth to age five. This age range is known as the critical period of language development. In addition, our research shows that intervention is the most effective when they occur in the early stages of pre-verbal development, when children usually learn appropriate language cues and basic vocabulary through direct immersion (Vaccari, C. and Marschark, M, 2017).

Based on the information gathered, the target audience which is deaf children with their hearing parents can be defined. The age range of the deaf children is 2-5.

Proposed solution

Funsigns takes advantage of AR object recognition and body tracking to provide an immersive and enjoyable learning experience. The implementation of the tablet application sought to meet following user needs: better communication skills, attractive and easy learning process, and enhance emotional connection between deaf children and their hearing parents. Overall, the

application intends to engage them learning ASL together, creating better communication and improve life quality.

To achieve the goals, object recognition with augmented reality and body tracking were implemented in this project after a wide range of market research and competitive analysis.

Design Process

The thesis project is a platform that aims to help parents raise their preschool deaf children, as well as improve how they communicate with each other. During the process, I started with some online researches about deaf, ASL, language deprivation, etc. to have a thorough understanding of the problem people are currently facing. And I conducted several interviews with deaf student from NTID of RIT and hearing people with deaf family members to have a comprehensive analysis. Then based on these people I created personas and explored their essential needs.

User Interview and Persona

Before the interview, I confirmed the goal is to understand deeper about the impact of the language environment with their families, how they communicate with their family members, how they learn ASL, and what's the difficult parts when they face language problems. Also I prepared some questions to encourage them describing their experience and feeling as much as

possible. During the initial interview, I asked about how the deaf student communicated with their hearing parents and some other prepared questions. However, I heard the answer which impressed me most. “It's terrible, I can barely talk [with] my parents. We primarily talk on e-mail and there are so many misunderstandings because we can't talk to each other. They don't even know me well or my deaf friends. [...] Home is stressful, so many problems, and it sucks but we can't do anything about it since talking is hard.” The research reveals that the communication between families influence their life quality instantly. Face-to-face communication let me find the deeper user needs and think about what they do, think, feel and see in their life. After that I talked with Karen which is my primary target audience. Karen’s youngest child has difficulties with hearing. She is having really hard time communicating with the child. She was advised to learn sign language but she didn’t know where to start. By hearing Karen’s story and synthesizing the interview, I created the personas which represent the typical audience in everyday life (see Figure 1).

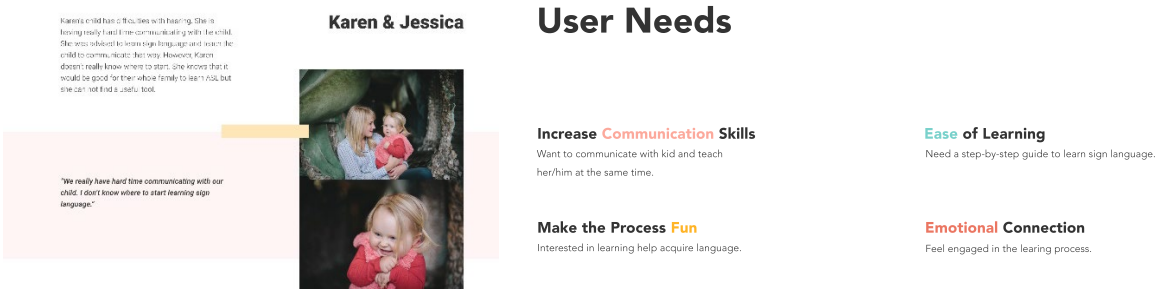


Figure 1&2: Persona and User common needs

In summary, the user research helped me better understanding their difficulties when faced learning sign language or living in a no common language environment. Owing to the target audience is face to children and parents, their core needs have similarity and differences. For example, the adult need a step-to-step guide to start learning ASL, while a fun process is more important to children. Therefore, it is important to gather all the information to meet various needs in the design solution.

Competitive Analysis

Through the competitive analysis, I found that Various technologies have been well applied as educational tools for deaf children, although many of the technologies are limited in capability and form. Also, different types learning tool have their own challenges which can become the chance in my design. Such as the ASL application, search function is the most direct way to learn how to sign an object, but it takes time. Users need to make the object clear and then find the best one from the result list. Overall, I conducted three represent different kinds of competitive products (see Figure 2). The competitive analysis helped frame my own product context and know more specifically about the essential functions of a language learning tool.

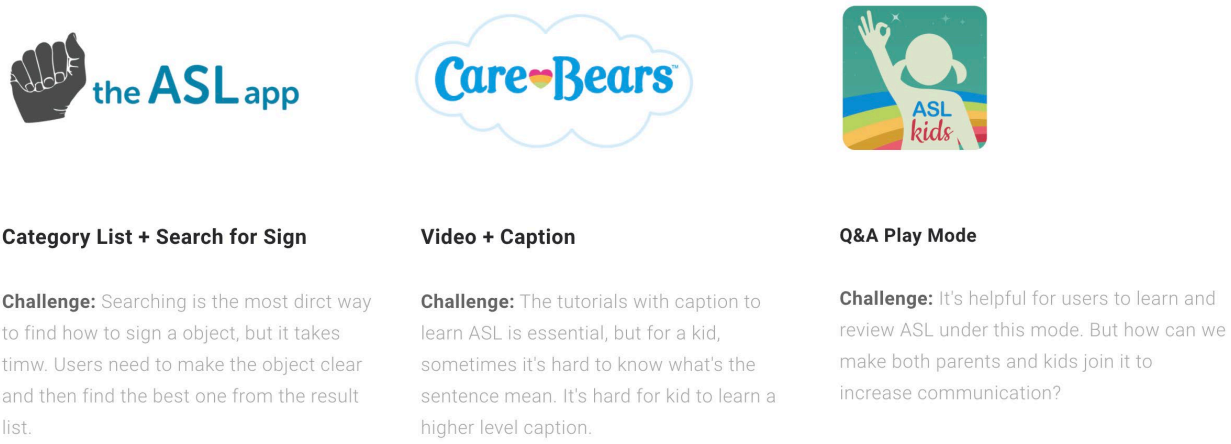


Figure 2: Competitive Analysis

Brainstorming and proposed solutions

Based on the user research and competitive analysis, brainstorming was conducted to find the better solution and user experience. To start with, all the main related part of learning ASL were listed (see Figure 3). Then, integrating suitable technology into the platform with acceptable and advanced methods to encourage the user learning sign language easily and improve communication.

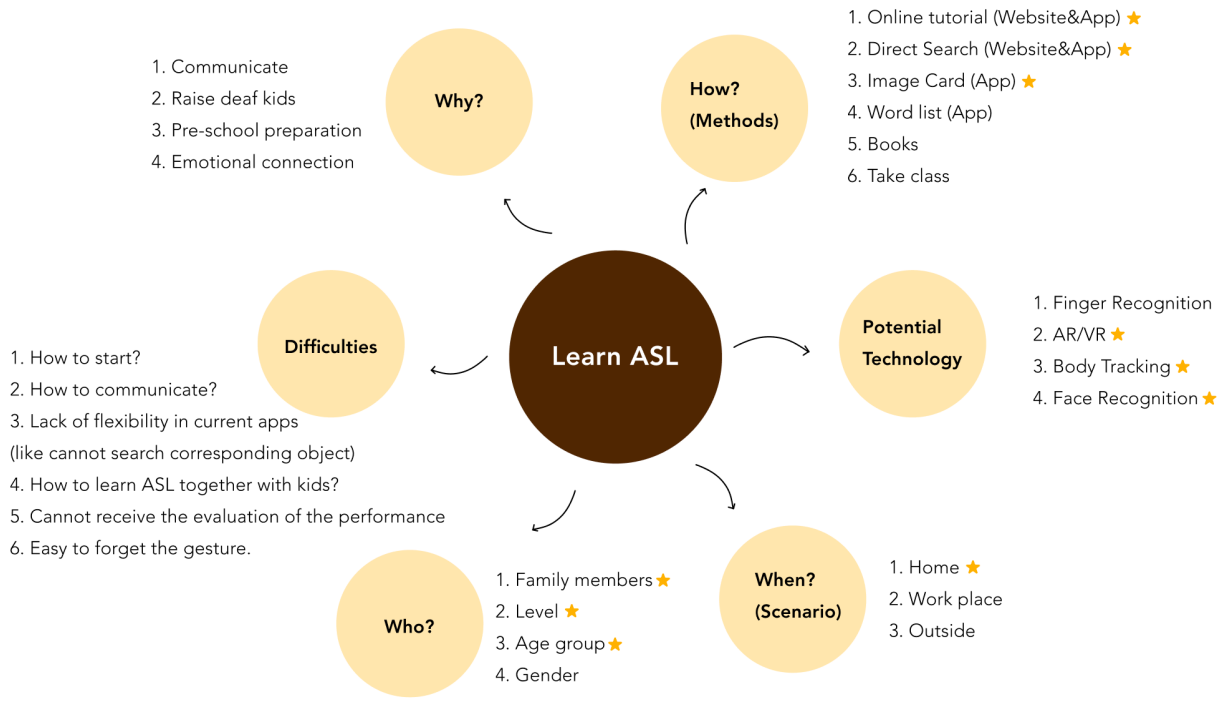


Figure 3: Brainstorming

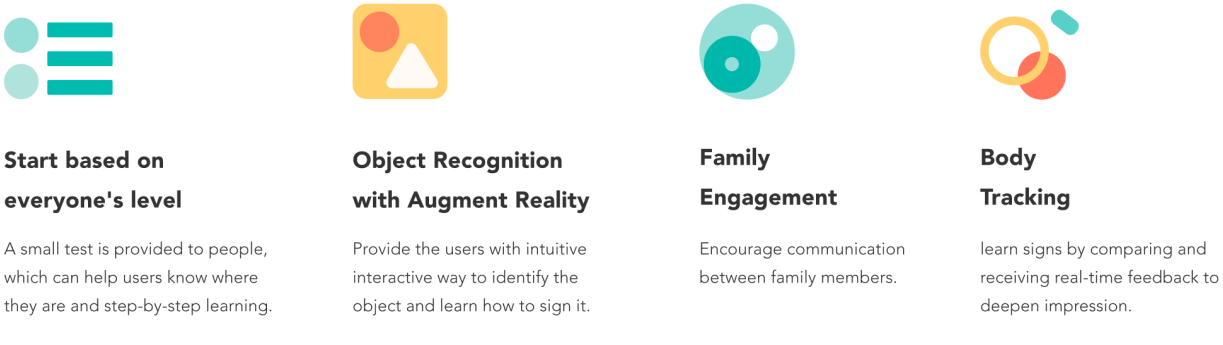


Figure 4: Proposed solutions

Aligning with the goal of learn sign language together, create better communication and improve life quality, the better solutions were proposed (see figure 4). We need to continue the ways which users used to do it and introduce new technologies to create an immersive language

environment. Firstly, for the users who don't know how to start, a small test can tell them where they are and how to learn step by step. Secondly, Augmented reality promises to provide unprecedented immersive experiences in the field of education. These systems enhance the real world by rendering virtual overlays on the user's field of view based on their understanding of the surroundings through the camera. Furthermore, object recognition with augment reality will not only provide the users intuitive way to identify the object and learn how to sign it, but also creating a complete sign language environment. Beyond that, Linguistic analyses showed that ASL is a language, not just a bunch of gestures. It uses space, coordinated handshapes and movements, facial expressions, and a unique syntax to build meaning (Dougherty, E, 2017). So body tracking with real-time feedback, not just finger recognition, will more obvious for users to understand and acquire. Last but not least, the platform should have the ability to hold all family members and promote them bond, enjoy and interact with each other.

Develop of Information and Design Ideations

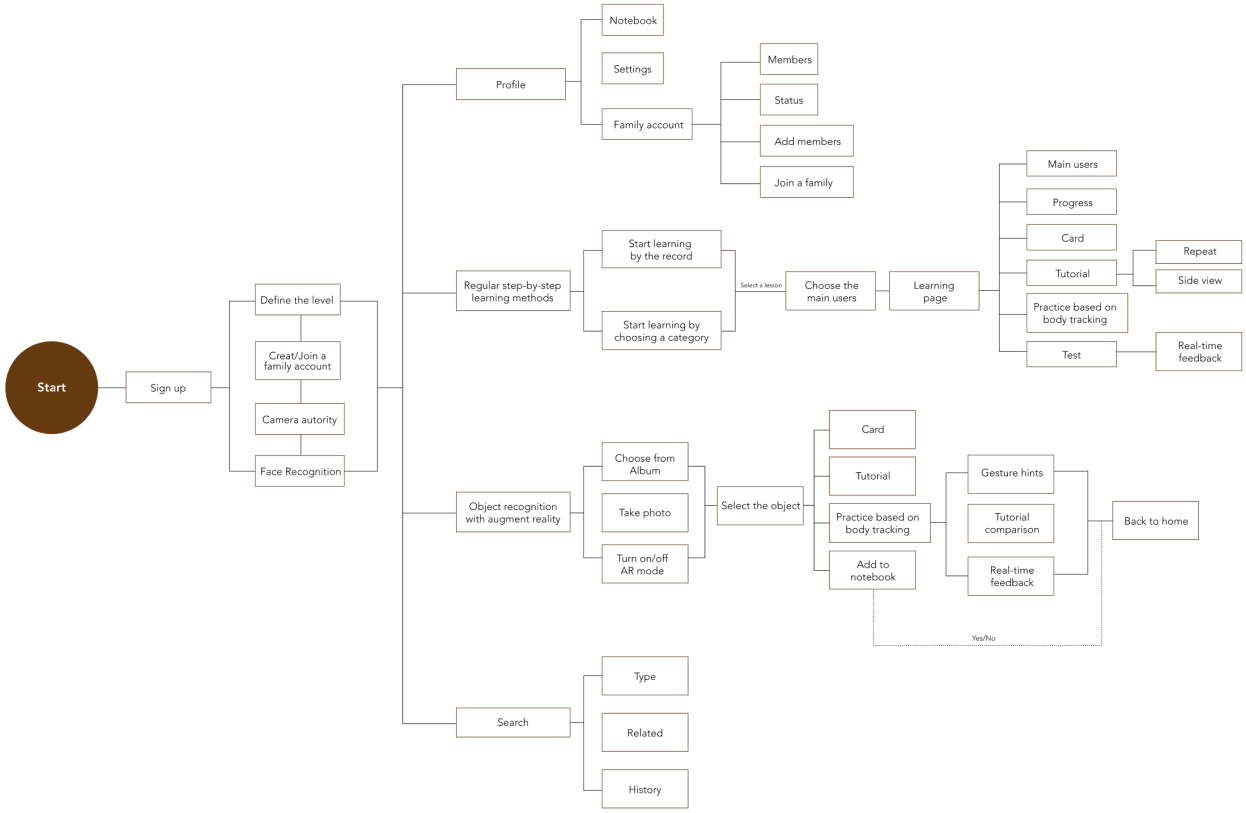


Figure 5: Information Architecture of Funsigns

Information architecture (see Figure 5) forms a skeleton of digital design project. Visual elements, functionality, interaction, and navigation are built according to the information architecture principles. The goal is to perform each task with the least amount of effort possible and create the easy and pleasant experience for the user. First of all, when the users sign up, they will go through a research deciding their level which influence the recommended courses. Then, the tablet application will have main two parts: Profile to record members' information and several methods to acquire sign language, including a series step-by-step course, search object by augment reality or typing.

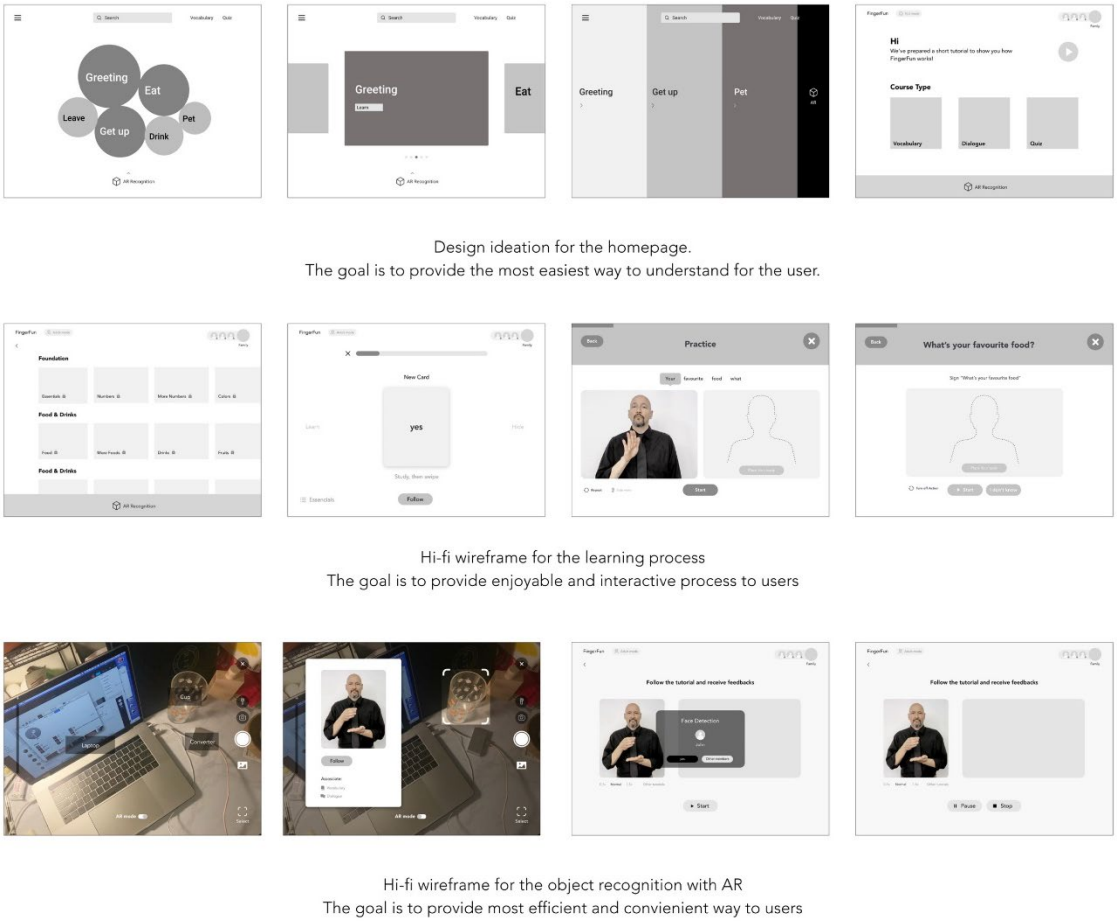


Figure 6: Part of design ideation and Hi-Fi wireframe

According to the solutions and goals, numerous interfaces were conducted for ideation (see Figure 6). Based on the initial design concept, some improvements were made and the style were confirmed for final design. The final version is not only the best approach to follow the logic work flow, but also trying to deliver a better visual aesthetic to the users.

User case

Three use cases were created to indicate different scenarios, we want Funsigns to be an effective and enjoyable tool to learn ASL.

How could users learn sign language anytime, anywhere and more efficient?

Before, When the users want to know how to sign an object, searching in an ASL application or Google is the most direct way. But it takes time. Users need to make the object clear, and then find the best one from the result list. Funsigns provides users instant sign language tutorials of the object based on spatial object recognition. The first step is open AR recognition function and turn on the AR mode, users can scan the object and it will be automatically recognized. After that the screen will pop up an image card and the users can follow the steps to learn how to sign it. For example, when the users are staying at home, they want to know how to sign a toy monkey on the carpet. They can turn on the AR function and scan this area. The application will identify the toy and other objects. Then the users just click the toy, they can follow the tutorial and practice it (see Figure 7, 8). Therefore, people can learn a sign whenever and wherever in an efficient way.

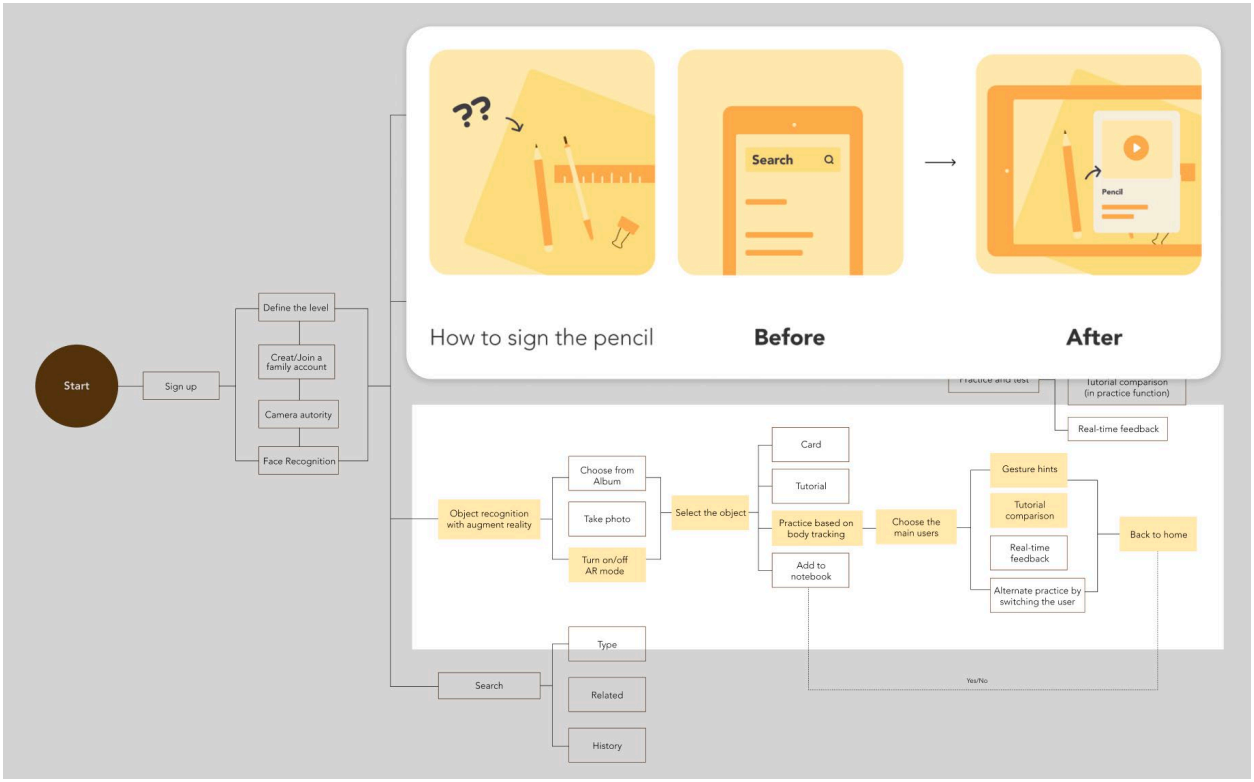


Figure 7: User scenario 1 and the position at IA

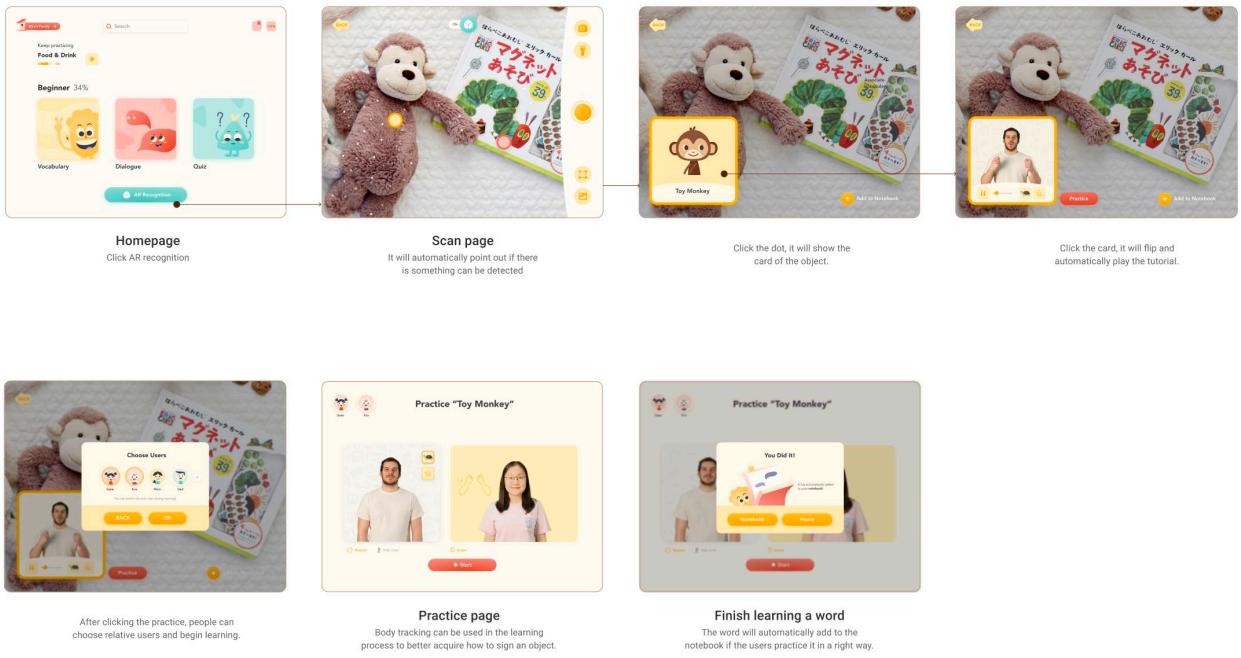


Figure 8: User case 1

How can users learn sign language more precise and have a deeper impression?

In general, users just learn and practice sign language on mobile phone by themselves. But there's no one give the feedbacks. But now, Funsigns visualized the feedback which can teach people at the first time to facilitate them acquiring sign language based on body tracing (see Figure 9, 10). For example, the users start a course to learn "what's your favorite food" dialogue. Then they will flip the card to watch the tutorial of signing the sentence. After watching it, the application will require users to sign the sentence by themselves. During the test time, the application will give feedback to users on every single words based on body tracking. If the user make mistake, it can exact tell users which part they are not precise. If the users have good performance, it can give bravo feedback immediately which give users more motivation.

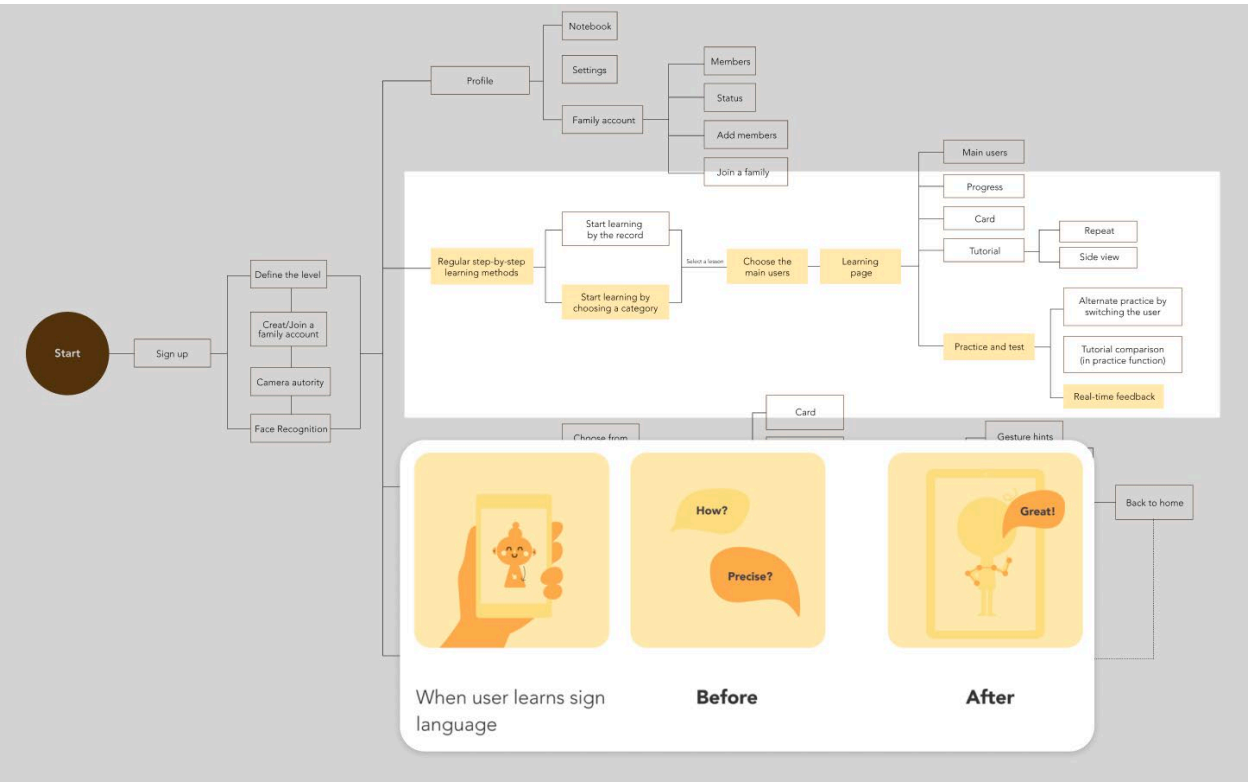


Figure 9: User scenario 2 and the position at IA

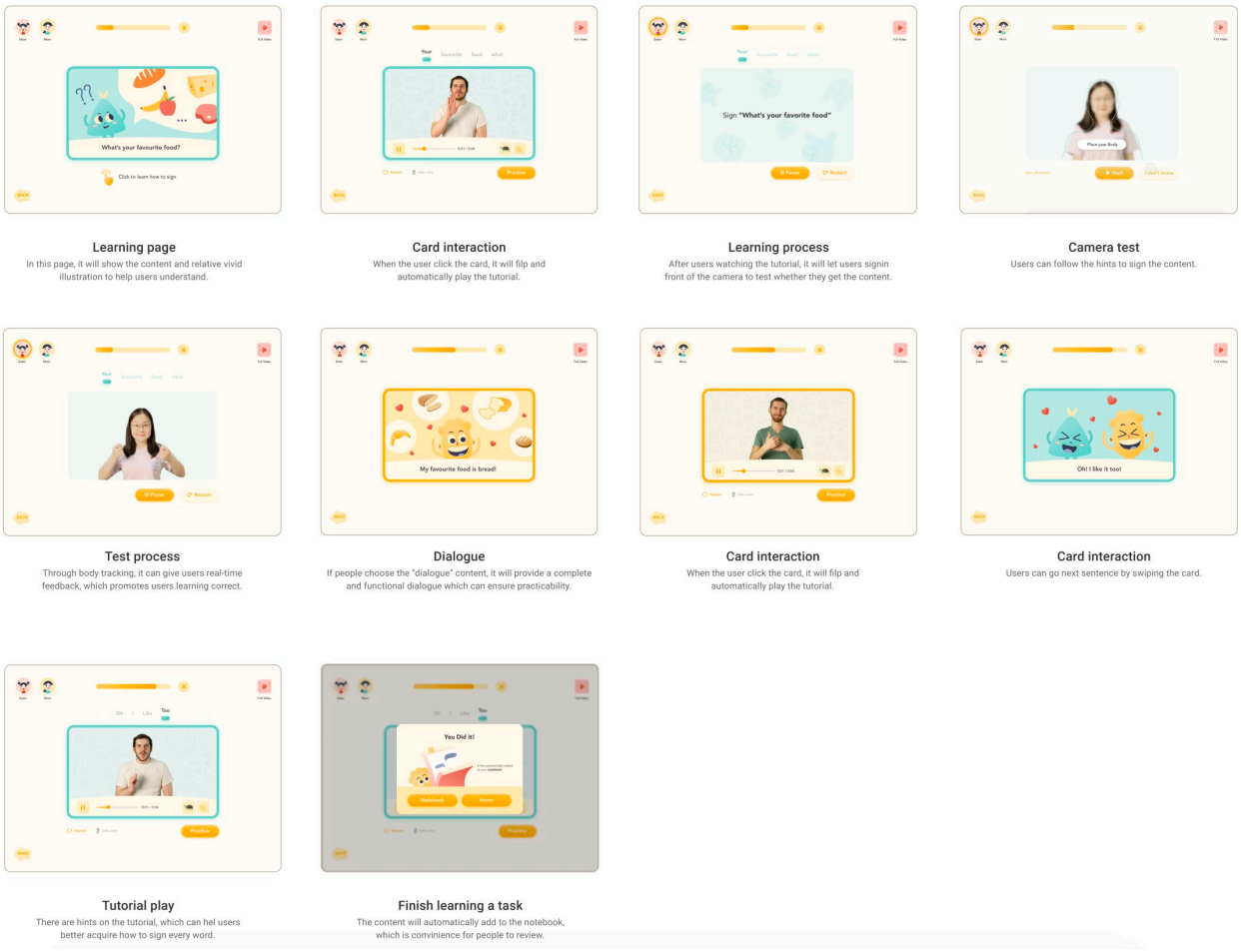
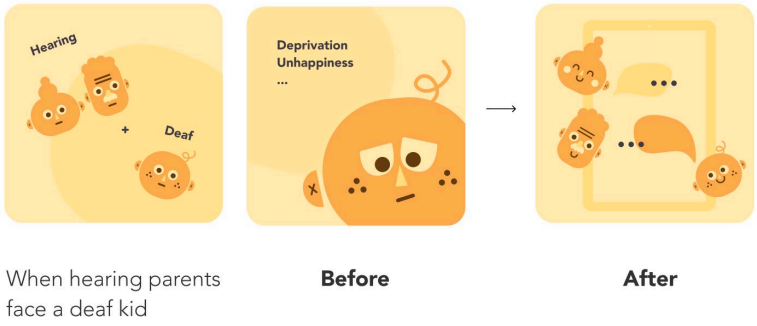


Figure 10: User case 2

How can Funsigns engage deaf children and hearing parents together to learn ASL?

Due to the lack of knowledge when faced with a deaf family member for the first time, parents tend to base their perceptions on obsolete stereotypes which lead to language deprivation of the child. But now, Funsigns provides a sign language environment and critical thinking ability to facilitate communication between hearing family and deaf child (see Figure 11, 12). It is mainly manifested in three aspects. First, the family account allows several users coexisting and they can know each other's status and progress which improve connection. Second, when start any

courses, the application requires choosing main users. In this way, each user can hold their own study progress and it is also a necessary preparation for dialogue interaction. For a two people dialogue course, the tutorial will have two different teachers to sign the conversation which is a hint that the users should interact with others. A conversation requires the users alternating with each other. Therefore, in Funsigns, the users not only can learn substantial signs together but also can interact functional dialogue with family members.



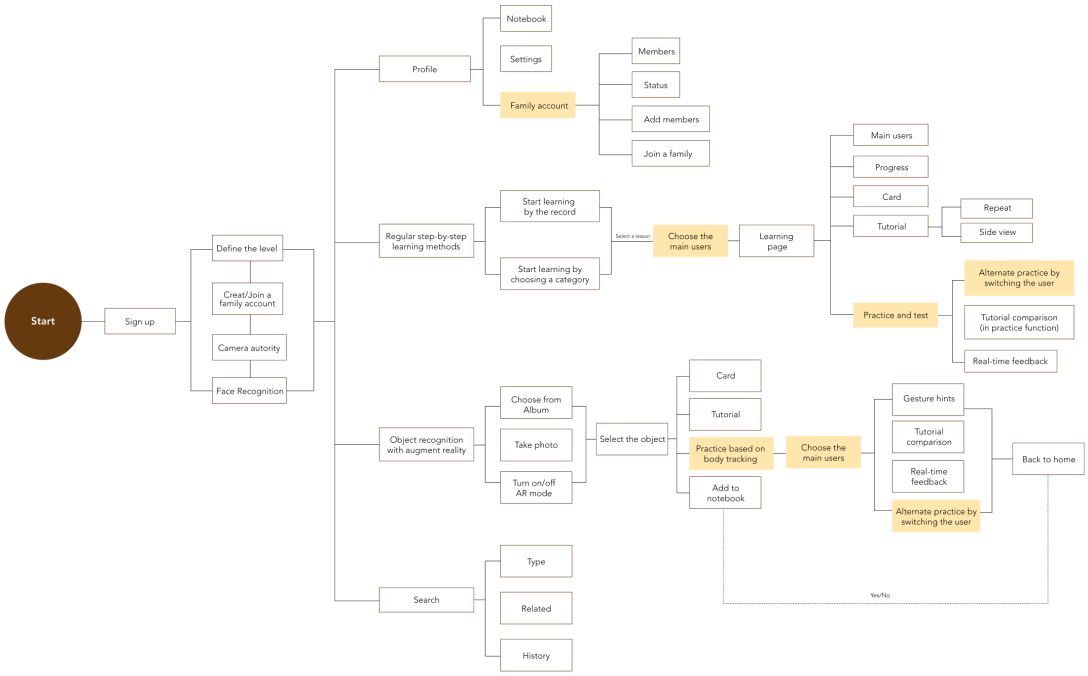


Figure 11: User scenario and the position at IA

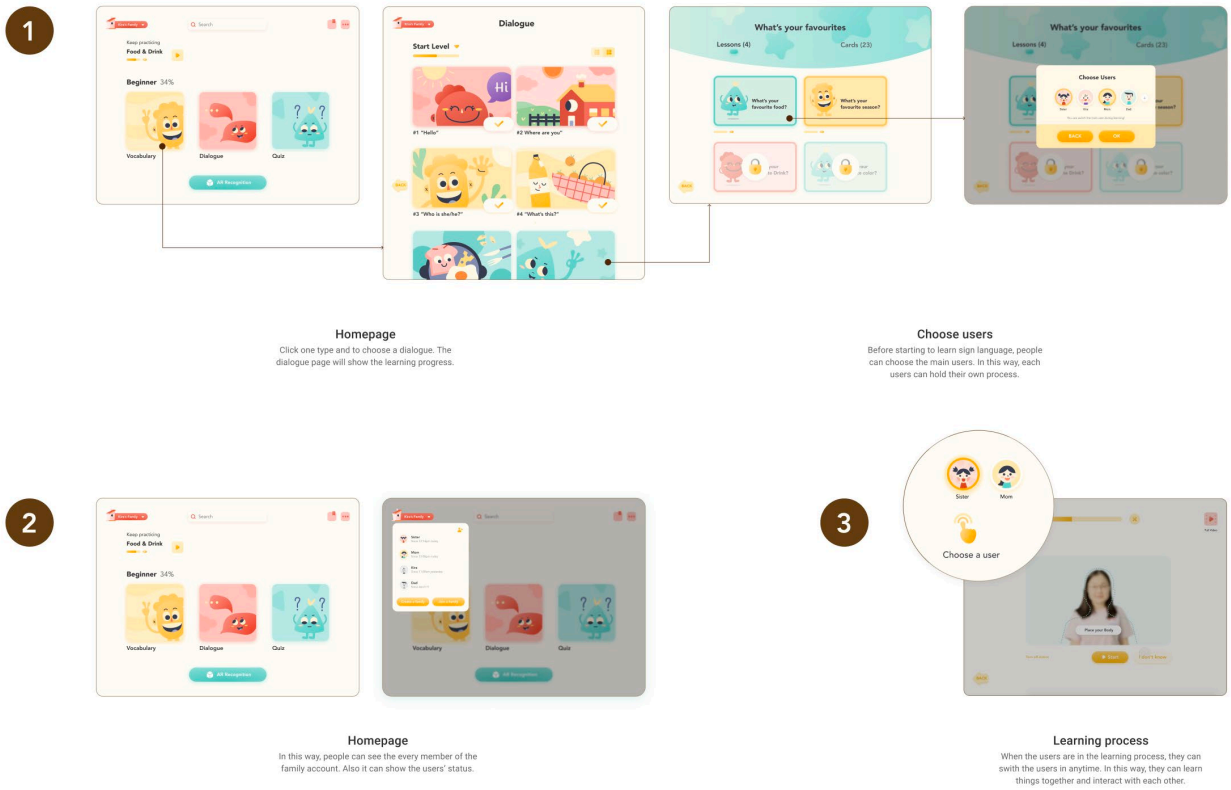


Figure 12: User case 3

Visual Identification

Design concept

First of all, we extracted two core keywords for the products, namely "children" and "education", and then we collected and sorted out the visual characteristics of the two categories of products related to this, as a reference point for brand style building. Then, I focused on how to seek the "differentiation" advantage in many of the same types of competition, and to meet the "deaf children's interest" core demands determined by the nature of the Funsigns product, and pay more attention to the potential demands of the core consumer group "hearing parents" on the "high quality sense" of the product content (see Figure 13).

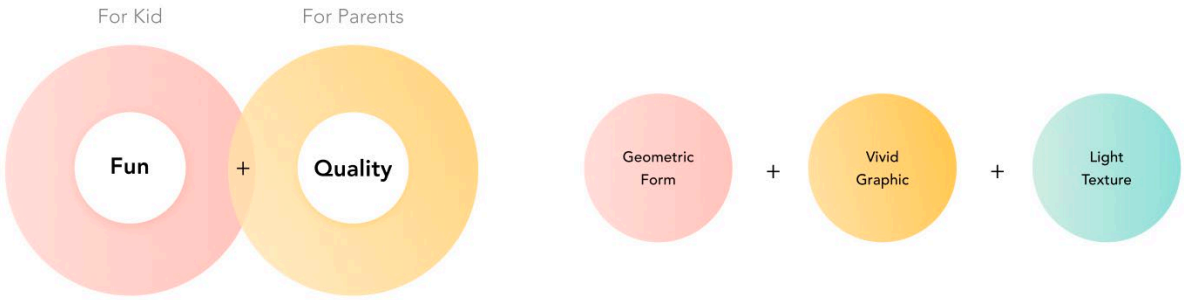


Figure 13: Design concept

Overall, A set of style bright, colorful, vibrant visual language, is the most indispensable brand characteristics of children's products. I try to interpret the brand character, logo, color, icon and font with a more geometric and pure design technique. The three shapes, circle, square and triangle, symbolize the origin of the form of all things, and are also the three initial shapes that are most easily perceived and remembered by children in the early stage of figure cognition. Then, the three shapes are applied to characters, UI interface, component elements, layout setting, dynamic effect expansion and other aspects, to add interest to Funsigns, while at the same time not losing the brand systematic visual language extension (see Figure 14, 15, 16).

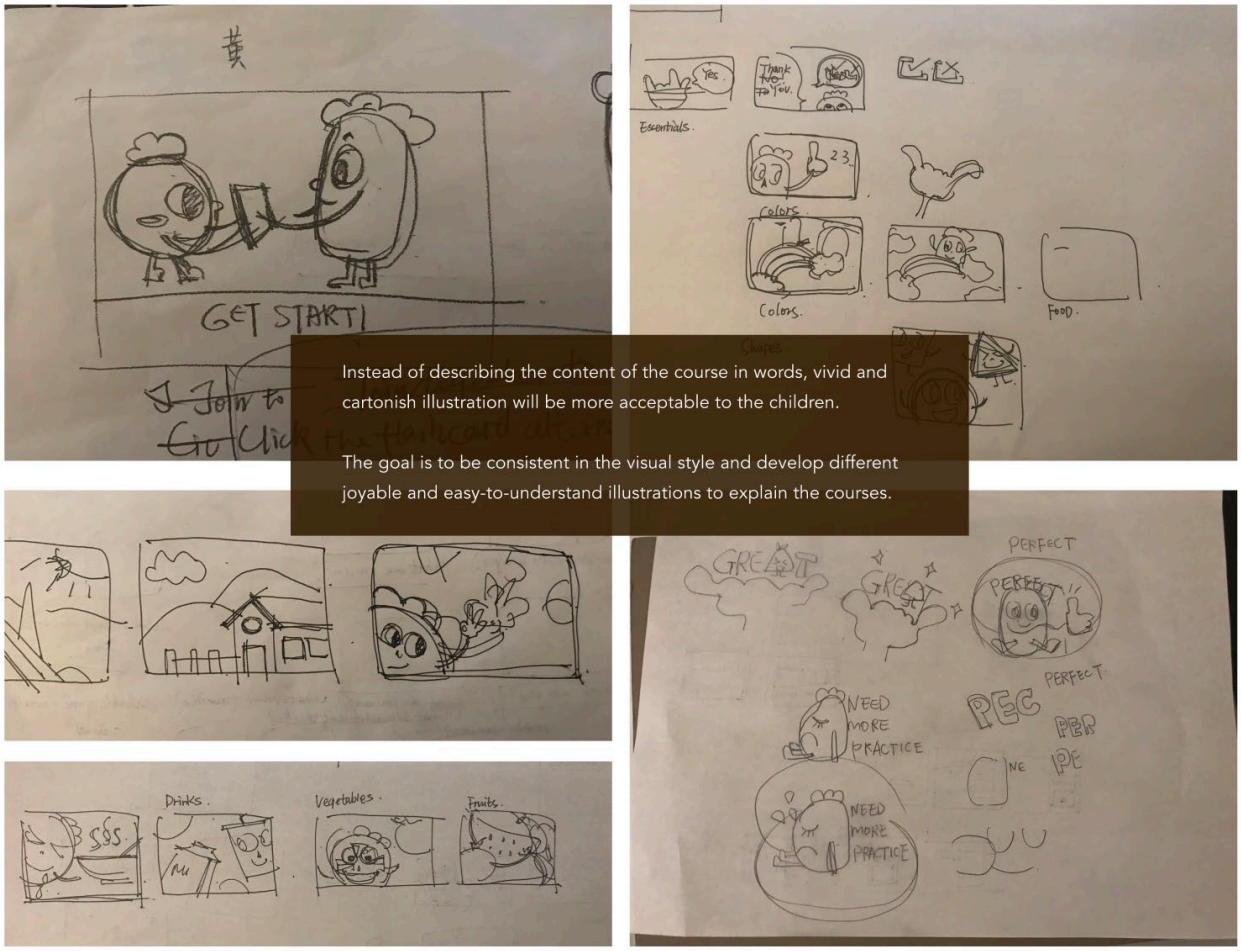
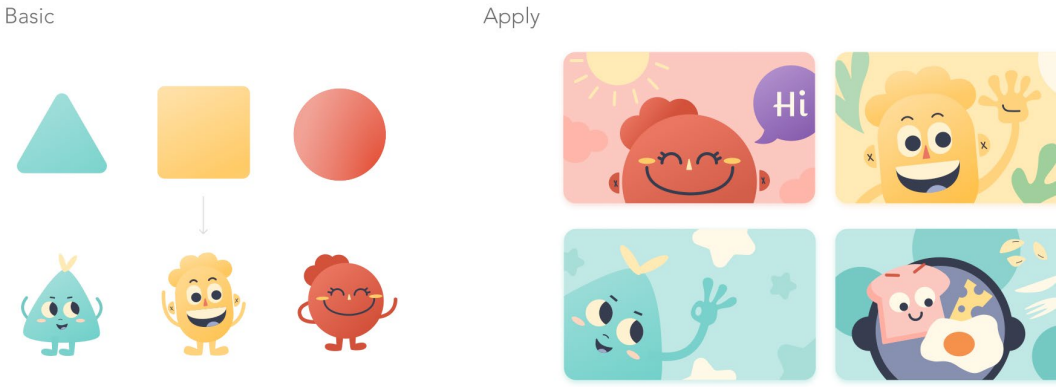


Figure 14: Visual design sketch



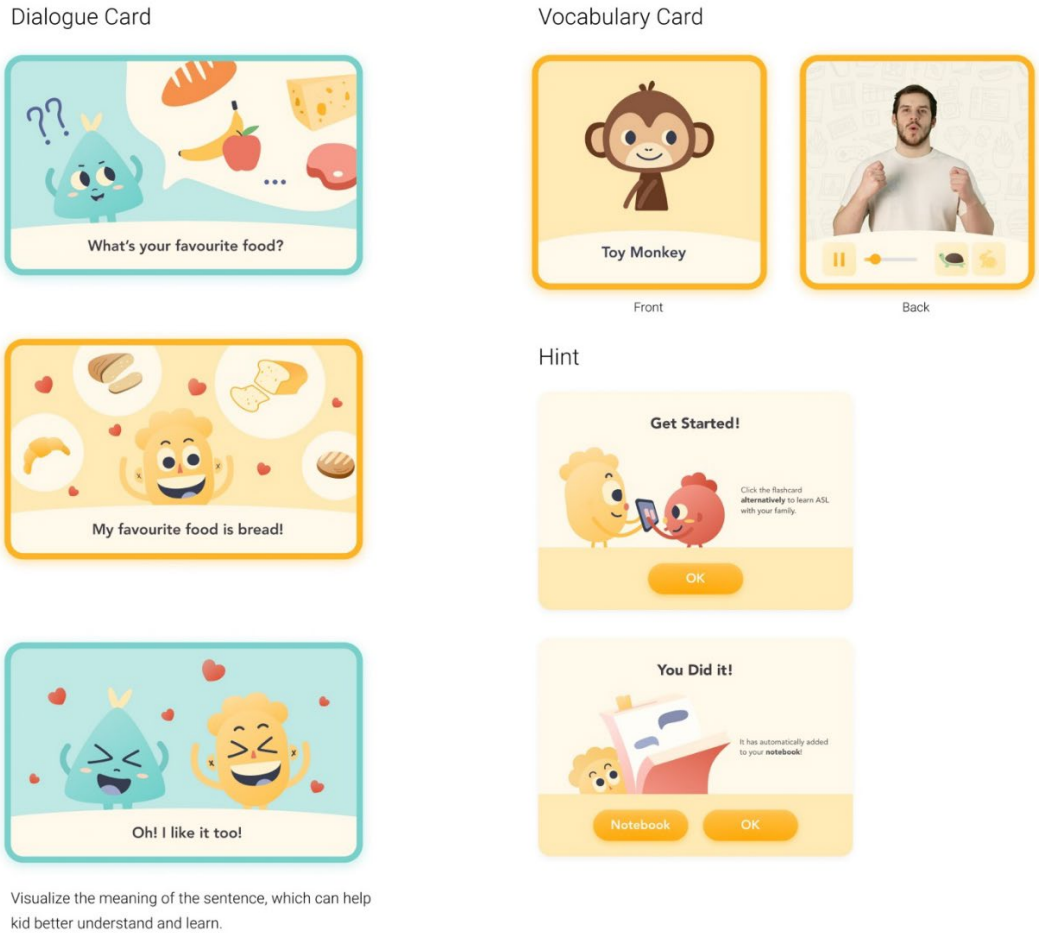


Figure 15&16: Design language extension

Color Theory

Colors affect the bodily functions, mind and emotions with the energy produced by light. Studies conducted clearly demonstrate the benefits of colors where the development of the brain, creativity, productivity and learning are concerned. For this reason, it is quite important to choose colors appropriate for children (Ertem, Ayben, 2019). Therefore, I chose "Red", "yellow", "blue" as the brand main color, hope to give children the color of cognition which is

from the most original "three primary color". The purpose is to provide users the most comfortable visual memory and to obtain their brand recognition (see Figure 17).

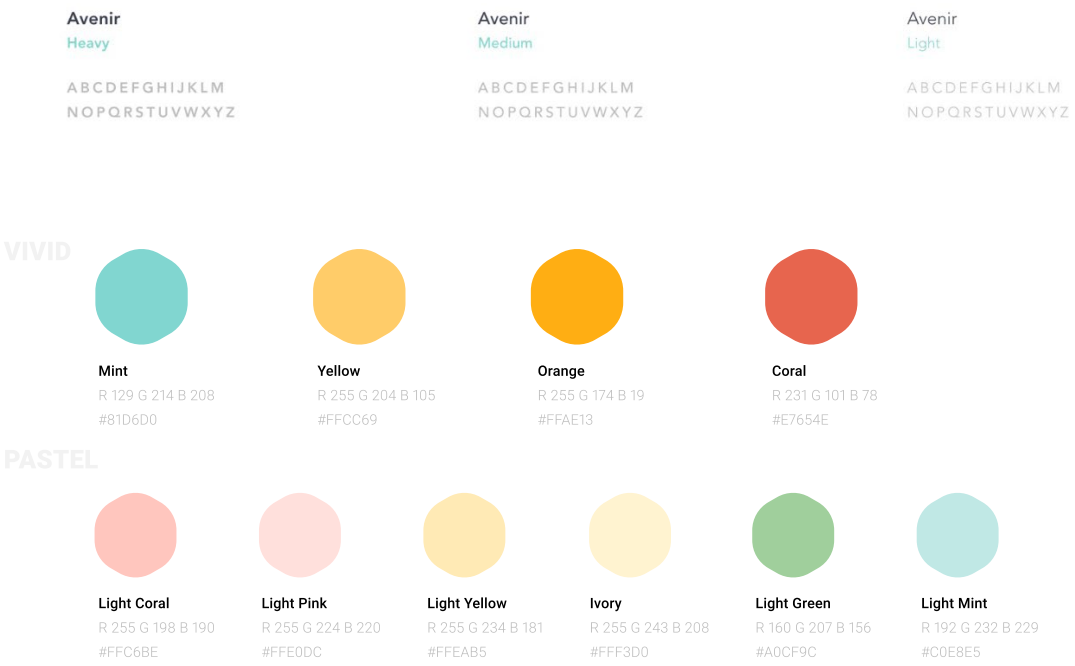


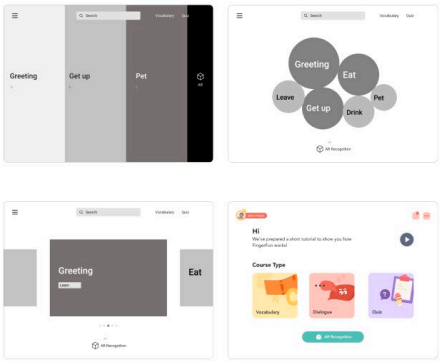
Figure 17: Typography and color design

Iterations

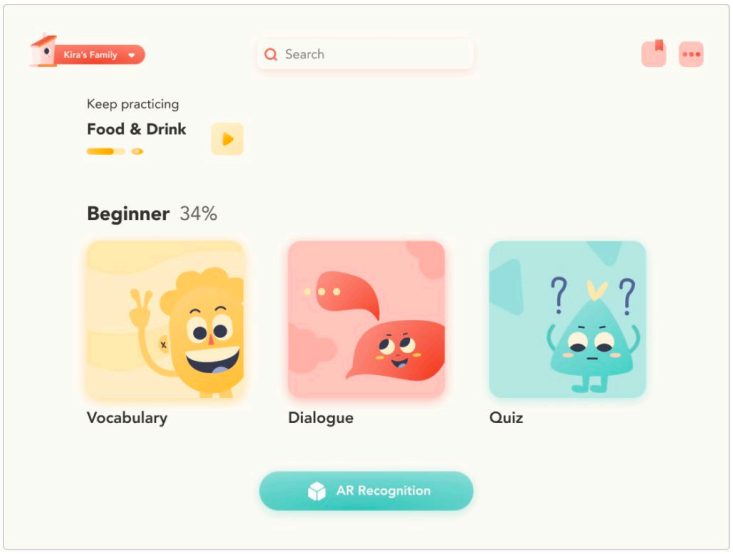
During the design process, I explored different design possibilities: From each repetition of the design I learn something that I can use for the next iteration (see Figure 18, 19, 20).

Hompage

More specific visual style
More Complete functions



Before

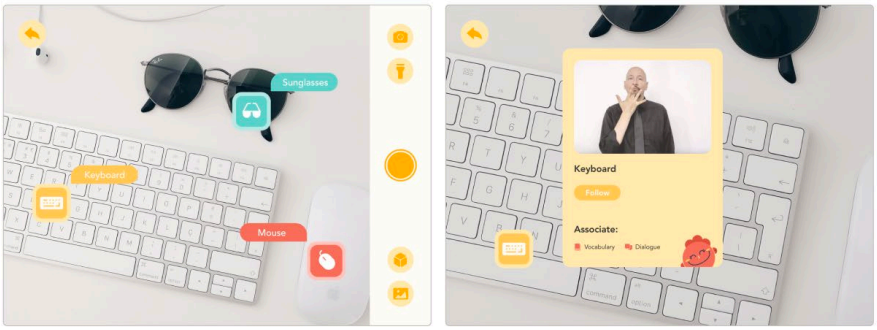


After

Figure 18: Iteration 1 - Homepage

Object Recognition Page

Before



Consistency:
Card
Illustration

After

Figure 19: Iteration 2 – Object recognition page

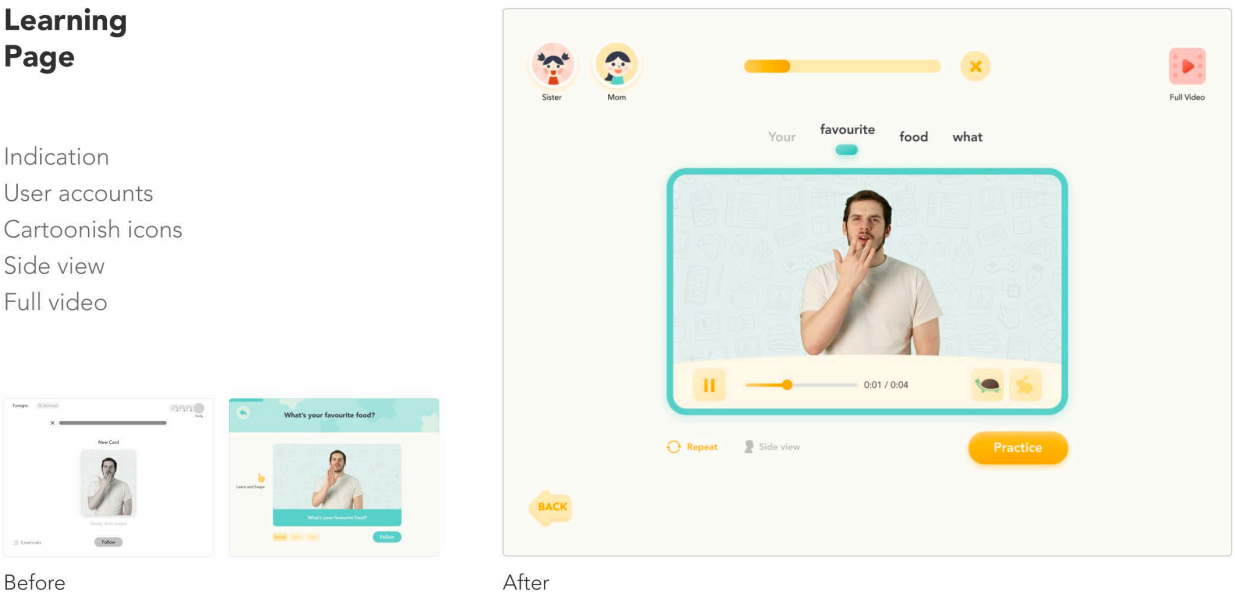


Figure 20: Iteration 3 – Learning page

Evaluation

During the period, several user tests were conducted for feedback and improvement, both design reviews from professors and user interviews helped me to create a better user experience (see Figure 21). Among the user testing, three main parts were asked. The first part was how to learn sign language in the application. The second part was how the body tracking encourage users learning. The third part is about creating the characters. The overall user experience was positive and the users can easily finish the workflow of Funsigns. They were attracted by the visual style and the vivid characters.

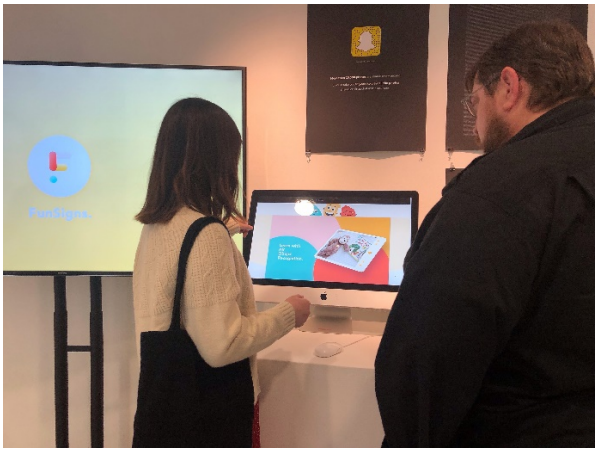


Figure 21: Usability testing

Conclusions

The overall purpose of this project was to help parents raise their preschool deaf childs, as well as improve how they communicate with each other. It is expected to be an educational and interactive tool where families can bond, enjoy, and interact with each other more. To approach this, Funsigns is applied with object recognition with augment reality, which provides an immersive and enjoyable experience in the field of language education and brings more chances for users to acquire sign language without content restrictions. Body tracking also plays an important role to encourage the users learning ASL. It is more tolerance and diversity than finger or face recognition, in the meanwhile, real-time feedbacks can be presented to users. With this technology, users can learn ASL more accurate and motivated. Moreover, With the presence of all forms of communication, the bond of the hearing parents and the deaf child will strengthen.

For the future iterations, it is a challenge for users to use the AR features today considering the network and the unpredictability of situations if people are in outside. However, this experiment and design ideation is worth to try. Besides, there are still lots of other design problems which need to be solved. For instance, how to make hearing parents more informed deafness through the implication of content, and how to explore more learning interactive ways like games to strengthen the bond between hearing parents and deaf kids. With the development of technology, it is hoped that this idea can become a powerful tool to help raise deaf children and give them a better future.

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